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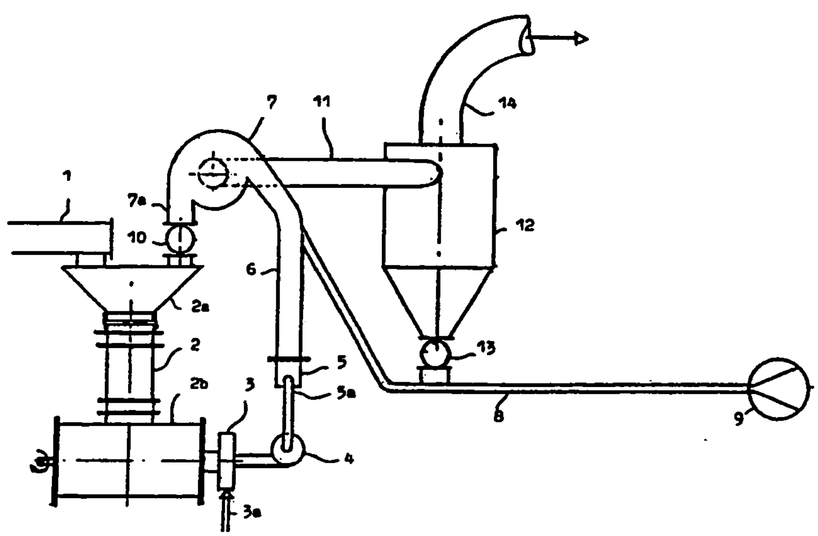
(54) Title: A METHOD AND AN EQUIPMENT FOR CLASSIFYING A GAS-SOLIDS FLOW COMING FROM A COUNTERJET PULVERIZER



(57) Abstract

The invention relates to a method and an equipment for classifying a gas-solids flow coming from a counterjet pulverizer (5), in which the gas-solids flow accelerated by an additional gas flow is led to a first, mainly a centrifugal-force based classification phase (7), from which a coarse fraction is returned to the pulverization and a fine fraction is led, supported by the gas flow, to a second classification phase. The invention is characterized in that the coarse fraction produced in the second classification phase (12) is mixed in a vigorous additional gas flow and the additional gas-solids mixture produced is led to the feed of the first classification phase (7) such that large speed differences occur therein, and the fine fraction is led, supported by the gas flow, to the next treatment phase.

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A method and an equipment for classifying a gas-solids flow coming from a counterjet pulverizer

The invention relates to a method and an equipment for classifying a gas-solids flow coming from a counterjet pulverizer, in which the gas-solids flow accelerated by an additional gas flow is led to a first, mainly a centrifugal-force based classification phase, from which a coarse fraction is returned to the pulverization and a fine fraction is led, supported by the gas flow, to a second classification phase.

The counterjet pulverizer technique developed by the inventors is mainly connected with a static or dynamic classifier. The operation of these classifier types is described e.g. in an earlier Finnish patent publication 81732 and in an international publication WO 90/06179.

If the number of over-coarse granules of the finished product is accurately limited, it is necessary to use a double or even triple series classification. The classifiers may be of a static or dynamic type or their combinations. A static classifier refers to a classifier, which contains no moving parts, but the classification effect is achieved only by means of a centrifugal force caused by the speed of the gas-solids flow. In a dynamic classifier, the classifier has, for intensifying the classification effect, a winged rotor rotating at a high speed and surrounding a fine-fraction outlet opening.

The coarse fraction of a second and possibly a next classifier is usually recovered as such depending on the product or returned directly to a feeding funnel of the counterjet pulverizer e.g. by means of a separate feed screw. The last-mentioned solution stresses the counterjet pulverizer to an unnecessary large extent, since part of the coarse fraction of the second classifier comprises

e.g. of easily decomposing fiber bundles, the decomposition of which does not require an additional pulverization in the jet pulverizer.

The object of the present invention is to eliminate the above-disadvantages, which has been achieved by means of a method, which is characterized in that the coarse fraction produced in the second classification phase is mixed in a vigorous additional gas flow and the additional gas-solids mixture produced is led to the feed of the first classification phase such that large speed differences occur therein, and the fine fraction is led, supported by the gas flow, to the next treatment phase. By means of this solution, the particle bundles possibly present in the coarse fraction of the second classifier may be readily decomposed by the action of shear forces caused by the additional or accelerating gas flowing at a high speed below the removal device of the classifier. A similar positive effect is achieved at the point of a connecting pipe between the counterjet pulverizer and the first classifier, where the additional or accelerating gas pipe terminates.

The other characteristics of the invention appear from the enclosed patent claims 2-10.

The invention is next described in more detail with reference to the accompanying drawing, in which

Fig. 1 shows as an example a first embodiment of the inventive equipment seen from one side,

Fig. 2 shows a second embodiment of the invention, and

Fig. 3 shows a third embodiment of the invention.

In the solution of Fig. 1, new material to be pulverized is brought by means of a feed screw 1 to a feeding device 2 of the pulverizer, which device 2 represents a so-called valve feeding type. From the valve feeder 2, the material drops to a pressurized balancing reservoir 2b, from which it is transferred as a uniform feed by means of a screw conveoyr to a fluidization chamber 3 of the equipment, in which a working gas is fed among the material for achieving a gas-solids suspension. The gas-solids suspension thus formed flows at a high speed as a uniform flow via a dividing device 4 to accelerating nozzles 5a of the counterjet pulverizer 5, which are directed to a common point, in which the gas-solids jets impact against each other, whereby the solid particles are pulverized into an ultrafine form. From the counterjet pulverizer 5 the pulverized gas-solids suspension flows via a connecting pipe 6 to a first, mainly centrifugal-force based classifier 7, into which the gas-solids suspension flows at a high speed mainly tangentially. For reaching an inlet speed as high as possible and an optimal solids ratio, additional or accelerating gas is led from an additional gas source 9 into the connecting pipe 6 via an additional gas pipe 8, which terminates at the connecting pipe 6 at a distance from the classifier 7, mainly parallel with the remaining part of the connecting pipe 6. On the peripheral surface of the classifier 7 is located a removal pocket 7a for the coarse fraction at a distance from the inlet opening of the classifier 7. The bottom section of the removal pocket 7a is provided with a closing device 10, preferably a rotor closing device, by means of which the coarse fraction is removed periodically from the removal pocket 7 and returned to a feeding funnel 2a of the counterjet pulverizer. On the other end surface of the classifier 7 is mainly centrally positioned a removal pipe 11 for the fine fraction, which terminates mainly tangentially at a second classifier 12. The second classifier 12 may possibly be of the same type

as the first classifier 7 or possibly a classifier of a cyclone type. The solution according to this invention is characterized in that a removal device 13 for the coarse fraction of the classifier 12 terminates at the additional or accelerating gas pipe 8, in which the coarse fraction is mixed at a high speed with the flowing additional or accelerating gas, and the additional gas-solids mixture thus formed is led into the connecting pipe 6 such that large speed differences occur locally therein, by means of which shear forces are achieved, which break the particle bundles possible contained in the feed flow of the connecting pipe 6. The fine fraction of the second classifier 12 is led, supported by the gas flow, via a removal pipe 14 to the next treatment phase.

If the material to be pulverized is from the beginning dry or nearly dry, new material to be pulverized may be led by means of the screw conveyor 1 and a gate feeder 15 to the gas flowing in the additional or accelerating gas pipe 8, whereby the material to be pulverized is once classified already before the pulverization, so the ultrafine fraction present in the feed is removed therefrom before it enters into the counterjet pulverizer.

If the number of over-coarse particles of the finished product is accurately limited, it is sometimes necessary to use a double or even triple series classification. In this case, the removal pipe 14 of the second classifier 12 for the fine fraction terminates tangentially at a third classifier 15, whose removal device 16 for the coarse fraction terminates at the same additional or accelerating gas pipe 8 as the corresponding removal device 13 of the second classifier 12. The fine fraction of the third classifier 15 is led via a fine-fraction removal pipe 17 e.g. into a storage silo or to a next treatment phase.

For intensifying the classification occurring in the first classifier 7, pure additional gas may be led into it as a flushing gas from the flushing air nozzle located at the removal pocket 7a of the classifier 7. Additional gas into this flushing air nozzle is led from the additional or accelerating gas source 9 via a branch pipe 18.

For achieving a classification effect as effective as possible in the inventive classification system, a dynamic classifier is used in at least one classification phase, i.e. a classifier, which is provided with a rotor preventing the removal of overcoarse particles at the inlet opening of the fine-fraction removal pipe 11 of the classifier 7.

Claims

1. A method for classifying a gas-solids flow coming from a counterjet pulverizer (5), in which the gas-solids flow accelerated by an additional gas flow is led to a first, mainly a centrifugal-force based classification phase (7), from which a coarse fraction is returned to the pulverization and a fine fraction is led, supported by the gas flow, to a second classification phase (12), characterized in that the coarse fraction produced in the second classification phase (12) is mixed in a vigorous additional gas flow and the additional gas-solids mixture produced is led to the feed of the first classification phase (7) such that large speed differences occur therein, and the fine fraction is led, supported by the gas flow, to the next treatment phase.

2. A method according to Claim 1, characterized in that also new dry or by its properties corresponding material to be pulverized is fed into the additional gas flow.

3. A method according to Claim 1 or 2, characterized in that the fine fraction of the second classification phase (12) is led, supported by the gas, also to a third classification phase (15), whose coarse fraction is mixed in the same additional gas flow as the coarse fraction of the second classification phase (12), and its fine fraction is led to the next treatment phase or to a storage silo.

4. A method according to any of the preceding Claims, characterized in that pure additional gas is led as a flushing gas into the first classification phase (7) at a removal pocket (7a) for the coarse fraction.

5. A classification system of a counterjet pulverizer, which comprises a first, mainly centrifugal-force based

classifier (7) connected to a connecting pipe (6) of the pulverizing chamber (5), an additional or accelerating gas pipe (8) terminating at this connecting pipe (6), a coarse-fraction removal pocket (7a) located on the peripheral surface of the first classifier (7) and periodically emptying into a feeding funnel (2a) of the counterjet pulverizer (5) and a fine-fraction removal pipe (11) positioned mainly centrally on its other end surface, which removal pipe (11) terminates mainly tangentially at the second classifier (12), **characterized** in that a coarse-fraction removal device (13) of the second classifier (12) terminates at the additional or accelerating gas pipe (8) and its fine-fraction removal pipe (14) terminates at the next treatment phase.

6. A classification system according to Claim 5, **characterized** in that the feeding screw (1) for a new material to be pulverized terminates at the feeding funnel (2a) of the counterjet pulverizer.

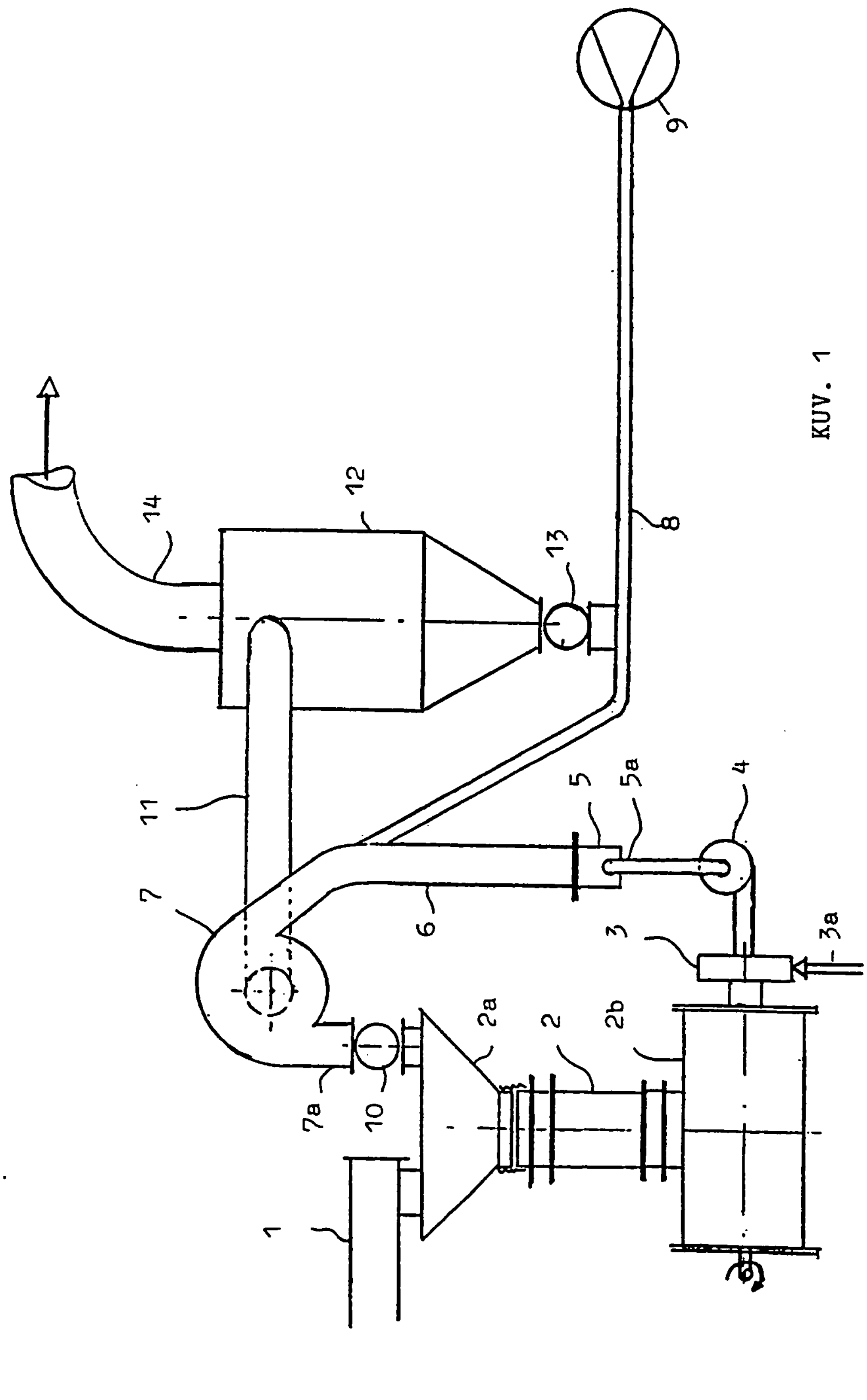
7. A classification system according to Claim 5, **characterized** in that the feeding devices (1, 15) for a new dry material to be pulverized terminate at the additional or accelerating gas pipe (8).

8. A classification system according to Claim 6 or 7, **characterized** in that the fine-fraction removal pipe (14) of the second classifier (12) terminates tangentially at a third classifier (15), whose coarse-fraction removal device (16) terminates at the same additional or accelerating gas pipe (8) as the coarse-fraction removal device (13) of the second classifier, and its fine-fraction removal pipe (17) terminates at the next treatment device or a storage silo.

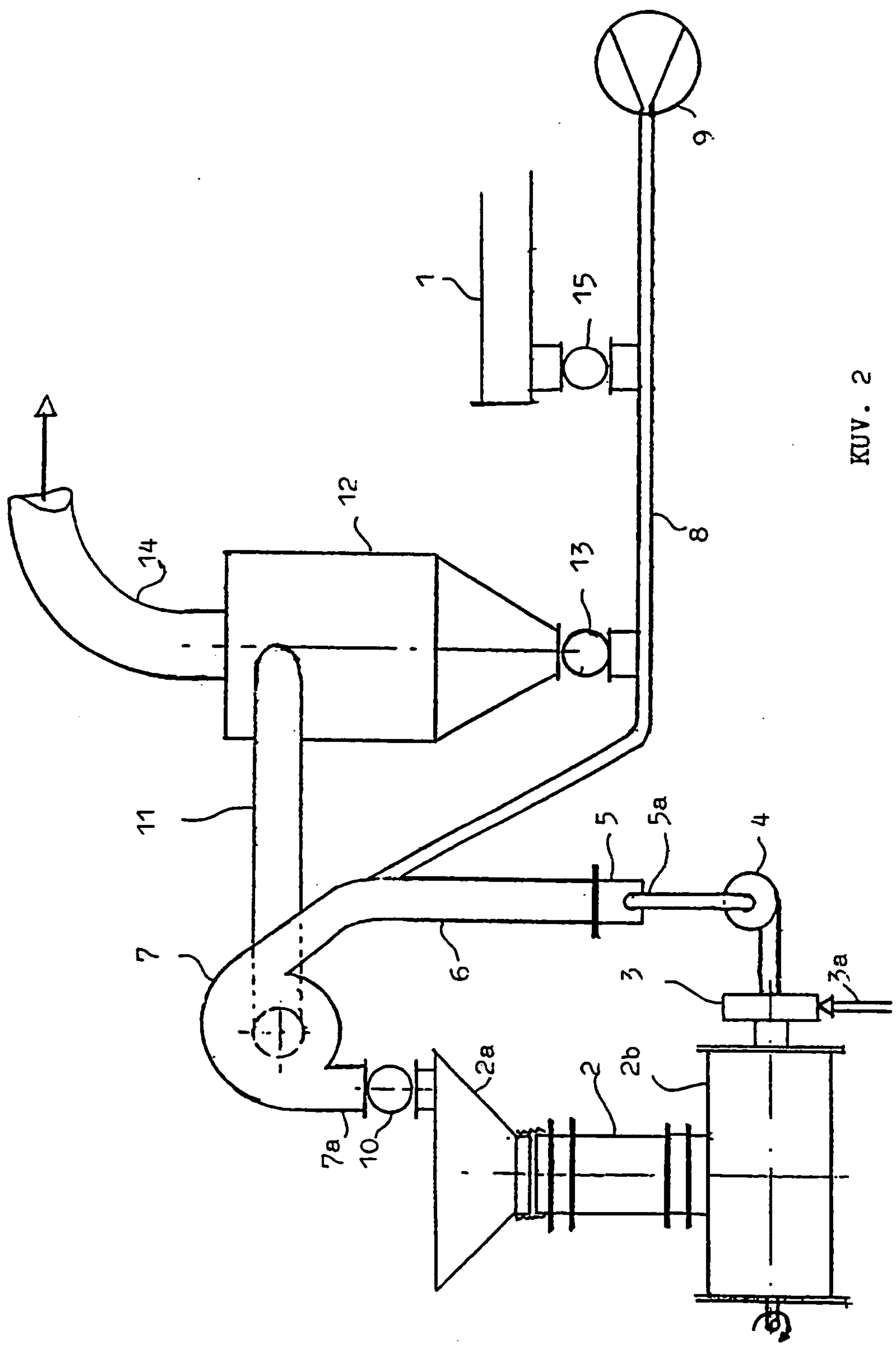
9. A classification system according to any of the preceding Claims, **characterized** in that from the additional or

accelerating gas source (9) is drawn a separate branch pipe (18) to a flushing air nozzle in the first classifier (7).

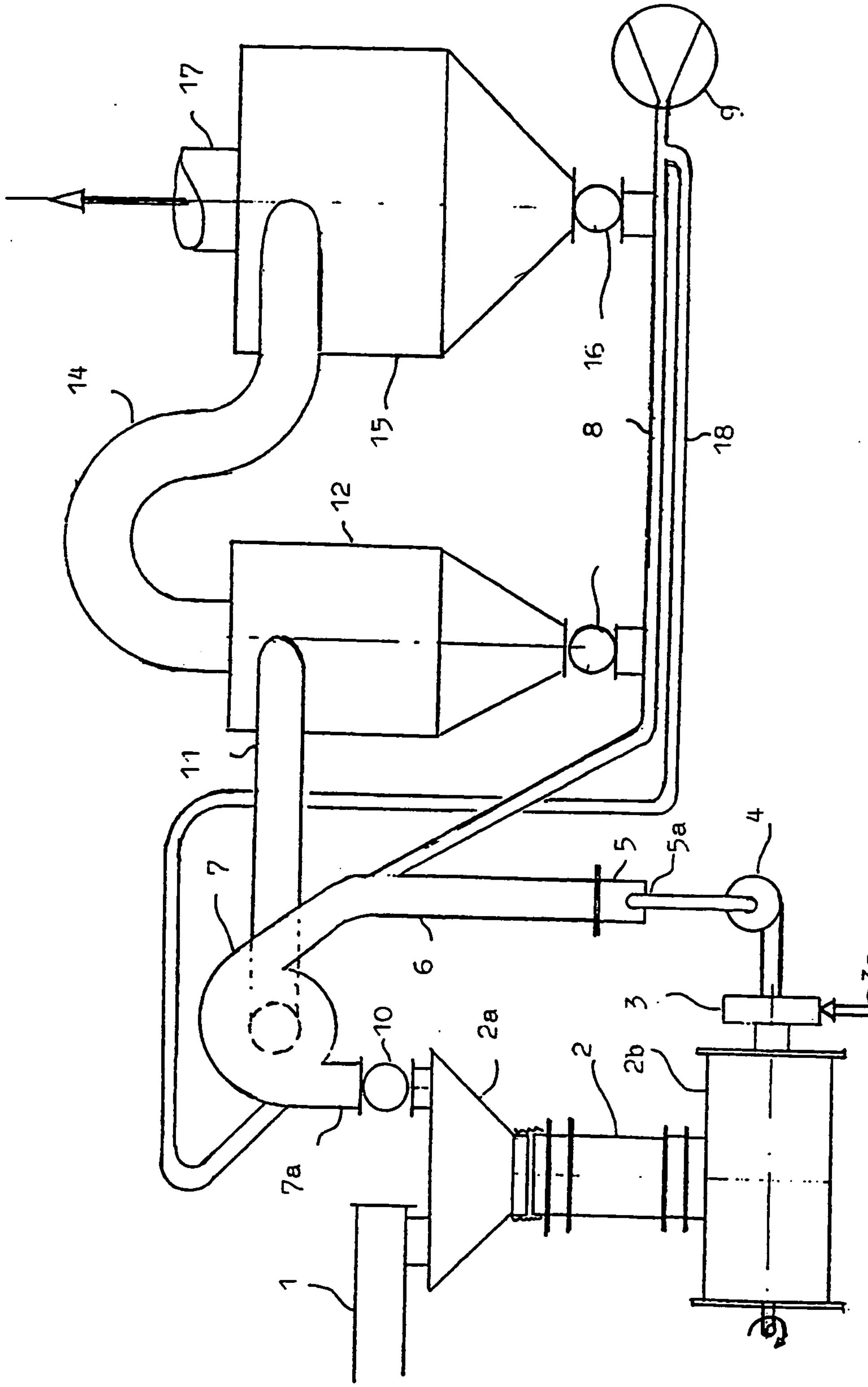
10. A classification system according to any of the Claims 5-9, **characterized** in that at least one classifier (7) is of a dynamic type.



KUV. 1



KUV. 2



KUV. 3

INTERNATIONAL SEARCH REPORT

International Application No PCT/FI 92/00023

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all)[6]

According to International Patent Classification (IPC) or to both National Classification and IPC

IPC5: B 02 C 19/06, 23/12

II. FIELDS SEARCHED

Minimum Documentation Searched[7]

Classification System	Classification Symbols
IPC5	B 02 C

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in Fields Searched[8]

SE,DK,FI,NO classes as above

III. DOCUMENTS CONSIDERED TO BE RELEVANT[9]

Category *	Citation of Document,[11] with indication, where appropriate, of the relevant passages [12]	Relevant to Claim No.[13]
A	WO, A1, 9006179 (OY FINNPULVA AB) 14 June 1990, see page 5, line 16 - line 17; abstract; figure 1; claim 12 --	1,4-6,9
A	WO, A1, 8801906 (LAROX OY ET AL) 24 March 1988, see abstract; figures 3,4 --	1,5

* Special categories of cited documents: [10]

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IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
28th April 1992	1992 -05- 06
International Searching Authority	**Signature of Authorized Officer**
SWEDISH PATENT OFFICE	Wiva Asplund Wiva Asplund

ANNEX TO THE INTERNATIONAL SEARCH REPORT ON INTERNATIONAL PATENT APPLICATION NO.PCT/FI 92/00023

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report.
The members are as contained in the Swedish Patent Office EDP file on 28/03/92
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Patent document cited in search report	Publication date	Patent family member(s)		Publication date
WO-A1- 9006179	90-06-14	AU-D-	4621489	90-06-26
		EP-A-	0445149	91-09-11
WO-A1- 8801906	88-03-24	AU-D-	6727587	88-04-07
		EP-A-	0328516	89-08-23